



# results of BLAST

## BLASTP 2.2.6 [Apr-09-2003]

RID: 1064601845-5875-417649.BLASTQ3

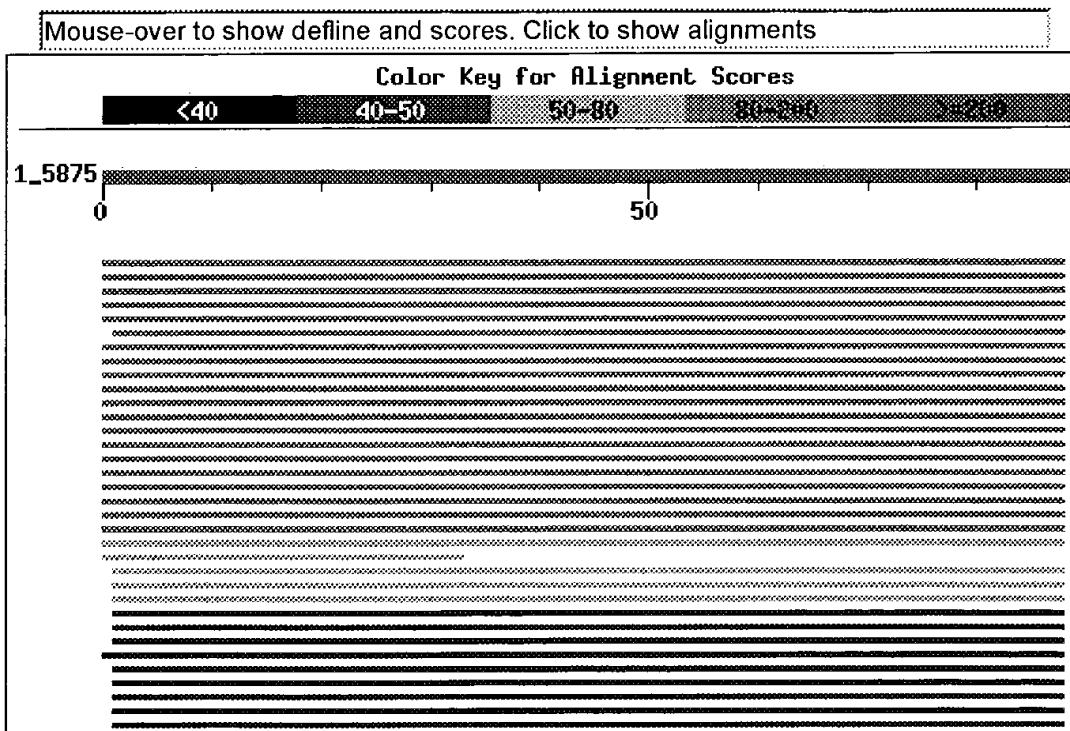
**Query=**

(89 letters)

**Database:** All non-redundant GenBank CDS  
translations+PDB+SwissProt+PIR+PRF  
1,538,680 sequences; 497,353,198 total letters

[Taxonomy reports](#)

### Distribution of 36 Blast Hits on the Query Sequence



Sequences producing significant alignments:

Score (bits) E Value

<u>gi 3342090 gb AAC27510.1 </u>	gastrin\cholecystokinin brain rec...	<u>165</u>	1e-40
<u>gi 30584635 gb AAP36570.1 </u>	Homo sapiens cholecystokinin B r...	<u>160</u>	4e-39
<u>gi 28875799 ref NP_795344.1 </u>	cholecystokinin B receptor; CC...	<u>160</u>	4e-39
<u>gi 1220299 gb AAA91831.1 </u>	cholecystokinin B receptor	<u>159</u>	1e-38
<u>gi 7690036 gb AAB30766.2 </u>	cholecystokinin B receptor [Homo ...	<u>159</u>	1e-38
<u>gi 440912 gb AAB28625.1 </u>	cholecystokinin B/gastrin receptor...	<u>134</u>	3e-31

gi 15911833 gb AAK38351.1	CCK-B/gastrin receptor variant [...]	129	9e-30	
gi 7677460 gb AAF67174.1 AF239668_1	CCK-B/gastrin receptor [...]	129	1e-29	
gi 27806271 ref NP_776687.1	cholecystokinin B receptor; CC...	120	4e-27	
gi 1169841 sp P46627 GASR_RABIT	Gastrin/cholecystokinin typ...	119	1e-26	
gi 26343361 dbj BAC35337.1	unnamed protein product [Mus mu...	107	4e-23	
gi 7106265 ref NP_031653.1	cholecystokinin B receptor; CCK...	107	5e-23	
gi 2654390 gb AAB87706.1	gastrin/CCK-B receptor [Canis fam...	104	3e-22	
gi 232131 sp P30552 GASR_CANFA	Gastrin/cholecystokinin type...	104	3e-22	
gi 399533 sp P30796 GASR_PRANA	Gastrin/cholecystokinin type...	102	2e-21	
gi 1813461 gb AAB41677.1	gastrin/cholecystokinin-B receptor	101	3e-21	
gi 1813459 gb AAB41676.1	gastrin/cholecystokinin receptor	100	8e-21	
gi 1813447 gb AAB41829.1	gastrin/cholecystokinin receptor	98	3e-20	
gi 6978617 ref NP_037297.1	cholecystokinin B receptor; CCK...	96	1e-19	
gi 1083622 pir  S48049	cholecystokinin B receptor - rat (fr...	92	2e-18	
gi 2495001 sp P70031 CCKR_XENLA	Cholecystokinin receptor (C...	62	2e-09	
gi 26333421 dbj BAC30428.1	unnamed protein product [Mus mu...	52	2e-06	
gi 2495000 sp Q63931 CCKR_CAVPO	Cholecystokinin type A rece...	52	3e-06	
gi 739858 prf  2004206A	cholecystokinin A receptor	51	3e-06	
gi 6978615 ref NP_036820.1	cholecystokinin A receptor [Rat...	51	4e-06	
gi 1582179 prf  2118221A	cholecystokinin A receptor	50	1e-05	
gi 4502607 ref NP_000721.1	cholecystokinin A receptor [Hom...	50	1e-05	
gi 2541920 dbj BAA22847.1	cholecystokinin type-A receptor ...	49	1e-05	
gi 32400155 emb CAD33800.1	cholecystokinin receptor [Gallu...	47	7e-05	
gi 12836122 dbj BAB23512.1	unnamed protein product [Mus mu...	46	1e-04	
gi 6753306 ref NP_033957.1	cholecystokinin A receptor [Mus...	46	1e-04	
gi 18088214 gb AAH20534.1	cholecystokinin A receptor [Mus ...	46	1e-04	
gi 1083155 pir  S50150	gastric CCK-A receptor - rabbit >gi ...	43	0.001	
gi 10719928 sp O97772 CCKR_RABIT	Cholecystokinin type A rec...	42	0.003	

## Alignments

[Get selected sequences](#)  [Select all](#)  [Deselect all](#)

>gi|3342090|gb|AAC27510.1| gastrin\cholecystokinin brain receptor [Homo sapiens]  
Length = 396

Score = 165 bits (418), Expect = 1e-40  
Identities = 89/91 (97%), Positives = 89/91 (97%), Gaps = 2/91 (2%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP 58  
RELYLGLRF DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP

Sbjct: 192 RELYLGLRFDGDSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP 251

Query: 59 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
ALELTALTAPGPGSGSRPTQAKLLAKKRVVR

Sbjct: 252 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 282

>gi|30584635|gb|AAP36570.1| Homo sapiens cholecystokinin B receptor [synthetic c  
Length = 448

Score = 160 bits (406), Expect = 4e-39  
 Identities = 89/91 (97%), Positives = 89/91 (97%), Gaps = 2/91 (2%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP 58  
 RELYLGLRF DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP  
 Sbjct: 243 RELYLGLRF DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP 302

Query: 59 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR  
 Sbjct: 303 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 333

[...]>gi|28875799|ref|NP\_795344.1| [■] cholecystokinin B receptor; CCK2 receptor; gastrin [Homo sapiens]  
 gi|417029|sp|P32239|GASR HUMAN [■] Gastrin/cholecystokinin type B receptor (CCK-B receptor)  
 gi|476975|pir||A47430 gastrin/cholecystokinin receptor B, short splice form - human  
 gi|179998|qb|AAA35660.1| [■] cholecystokinin receptor  
 gi|306489|qb|AAA35657.1| [■] cholecystokinin-B/gastrin receptor  
 gi|406076|qb|AAC37528.1| [■] gastrin receptor  
 gi|436040|dbj|BAA02564.1| [■] cholecystokinin receptor [Homo sapiens]  
 gi|12653895|cb|AAH00740.1| [■] Cholecystokinin B receptor [Homo sapiens]  
 gi|28316421|dbj|BAA04759.2| cholecystokinin-B receptor/gastrin receptor [Homo sapiens]  
 gi|30582417|qb|AAP35435.1| [■] cholecystokinin B receptor [Homo sapiens]  
 gi|32482023|qb|AAP84364.1| [■] cholecystokinin B receptor [Homo sapiens]  
 Length = 447

Score = 160 bits (405), Expect = 4e-39  
 Identities = 89/91 (97%), Positives = 89/91 (97%), Gaps = 2/91 (2%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP 58  
 RELYLGLRF DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP  
 Sbjct: 243 RELYLGLRF DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP 302

Query: 59 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR  
 Sbjct: 303 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 333

[...]>gi|1220299|qb|AAA91831.1| [■] cholecystokinin B receptor  
 Length = 447

Score = 159 bits (401), Expect = 1e-38  
 Identities = 88/91 (96%), Positives = 89/91 (97%), Gaps = 2/91 (2%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP 58  
 RELYLGLRF DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP  
 Sbjct: 243 RELYLGVR DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP 302

Query: 59 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR  
 Sbjct: 303 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 333

**[gi|7690036|gb|AAB30766.2|** **cholecystokinin B receptor [Homo sapiens]**  
Length = 447

Score = 159 bits (401), Expect = 1e-38  
Identities = 88/91 (96%), Positives = 89/91 (97%), Gaps = 2/91 (2%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRP 58  
RELYLGLRF DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVG+DSDGCYVQLPRSRP

Sbjct: 243 RELYLGLRFDGDSQSRVRNQGGLPGAVHQNGRCRPETGAVGKDSDGCYVQLPRSRP 302

Query: 59 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
ALELTALTAPGPGSGSRPTQAKLLAKKRVVR

Sbjct: 303 ALELTALTAPGPGSGSRPTQAKLLAKKRVVR 333

**[gi|440912|gb|AAB28625.1|** cholecystokinin B/gastrin receptor, CCKB/gastrin receptor, cytoplasmic domain} [human, small cell lung cancer, Peptide PartialMutant, 90 aa]

**[gi|440913|gb|AAB28626.1|** cholecystokinin B/gastrin receptor, CCKB/gastrin receptor, cytoplasmic domain} [human, Peptide Partial, 90 aa]  
Length = 90

Score = 134 bits (337), Expect = 3e-31  
Identities = 88/90 (97%), Positives = 88/90 (97%), Gaps = 2/90 (2%)

Query: 2 ELYLGLRF--DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPA 59  
ELYLGLRF DSDSDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPA

Sbjct: 1 ELYLGLRFDGDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPA 60

Query: 60 LEALTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
LELTALTAPGPGSGSRPTQAKLLAKKRVVR

Sbjct: 61 LEALTALTAPGPGSGSRPTQAKLLAKKRVVR 90

**[gi|15911833|gb|AAK38351.1|** CCK-B/gastrin receptor variant [Homo sapiens]

**[gi|23451715|gb|AAN32829.1|AF441129\_1|** cholecystokinin-C receptor [Homo sapiens]  
Length = 516

Score = 129 bits (325), Expect = 9e-30  
Identities = 63/63 (100%), Positives = 63/63 (100%)

Query: 27 GAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPALELTALTAPGPGSGSRPTQAKLLAKKR 86  
GAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPALELTALTAPGPGSGSRPTQAKLLAKKR

Sbjct: 340 GAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPALELTALTAPGPGSGSRPTQAKLLAKKR 399

Query: 87 VVR 89  
VVR

Sbjct: 400 VVR 402

Score = 35.4 bits (80), Expect = 0.21  
Identities = 27/29 (93%), Positives = 27/29 (93%), Gaps = 2/29 (6%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPG 27  
RELYLGLRF DSDSDSQSRVRNQGGLPG

Sbjct: 243 RELYLGLRFDGDSQSRVRNQGGLPG 271

[>] >gi|7677460|gb|AAF67174.1|AF239668 1 [!] CCK-B/gastrin receptor [Homo sapiens]  
Length = 516

Score = 129 bits (324), Expect = 1e-29  
Identities = 63/63 (100%), Positives = 63/63 (100%)

Query: 27 GAVHQNGRCRCPETGAVGEDSDGCVQQLPRSRPAELTALTAPGPGSGSRPTQAKLLAKKR 86  
GAVHQNGRCRCPETGAVGEDSDGCVQQLPRSRPAELTALTAPGPGSGSRPTQAKLLAKKR  
Sbjct: 340 GAVHQNGRCRCPETGAVGEDSDGCVQQLPRSRPAELTALTAPGPGSGSRPTQAKLLAKKR 399

Query: 87 VVR 89  
VVR  
Sbjct: 400 VVR 402

Score = 35.4 bits (80), Expect = 0.21  
Identities = 27/29 (93%), Positives = 27/29 (93%), Gaps = 2/29 (6%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPG 27  
RELYLGLRF DSDSDSQSRVRNQGGLPG  
Sbjct: 243 RELYLGLRFDGDSDSQSRVRNQGGLPG 271

[>] >gi|27806271|ref|NP\_776687.1| [!] cholecystokinin B receptor; CCK2 receptor [Bos t  
ci|3023830|sp|P79266|GASR\_BOVIN Gastrin/cholecystokinin type B receptor (CCK-B re  
ci|1836140|gb|AAB46896.1| [!] cholecystokinin B-gastrin receptor; CCKB-gastrin rece  
taurus]  
gi|1588667|prf||2209271A cholecystokinin-B/gastrin receptor  
Length = 454

Score = 120 bits (302), Expect = 4e-27  
Identities = 67/98 (68%), Positives = 72/98 (73%), Gaps = 9/98 (9%)

Query: 1 RELYLGLRFDSDSQSRVR-----NQGGLPGAVHQNGRCRCPETGAVGEDSDGCVQL 53  
RELYLGLRF DSDS+S+ R G G NGRCR ET GED DGCYVQL  
Sbjct: 243 RELYLGLRFDGDSDSESQSRVGSQGGLPGGTGQGPAQANGRCRSETRLAGEDGDGCYVQL 302

Query: 54 PRSRPALELTALTA--PGPGSGSRPTQAKLLAKKRVVR 89  
PRSRPALE++ALTA PGPGSG+RP QAKLLAKKRVVR  
Sbjct: 303 PRSRPALEMSALTAPTPGPGSGTRPAQAKLLAKKRVVR 340

[>] >gi|1169841|sp|P46627|GASR\_RABIT Gastrin/cholecystokinin type B receptor (CCK-B  
gi|1083156|pir||JC2459 gastrin/cholecystokinin B receptor - rabbit  
gi|495665|gb|AAA31i194.1| gastrin  
Length = 452

Score = 119 bits (297), Expect = 1e-26  
Identities = 76/98 (77%), Positives = 78/98 (79%), Gaps = 9/98 (9%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQ-----GGLPGAVHQNGRCRCPETGAVGEDSDGCVQL 53  
RELYLGLRF DSDS+S+SQSRVR Q G PG VHQNRCRPE G GED DGCYVQL  
Sbjct: 241 RELYLGLRFDGDSDSESQSRVRGQGGLPGGAAPGPVHQNGRCRPEAGLAGEDGDGCYVQL 300

Query: 54 PRSRPALELTALTAP--GPGSGSRPTQAKLLAKKRVVR 89  
PRSRPALEL+ALTAP GPG G RP QAKLLAKKRVVR  
Sbjct: 301 PRSRPALELSALTAPISGPGPGPRPAQAKLLAKKRVVR 338

[>] >gi|26343361|dbj|BAC35337.1| [■] unnamed protein product [Mus musculus]  
Length = 453

Score = 107 bits (267), Expect = 4e-23  
Identities = 66/97 (68%), Positives = 68/97 (70%), Gaps = 8/97 (8%)

Query: 1 RELYLGLRFDSQSDS--QSRVRNQGGLPGA-----VHQNGRCRPETGAVGEDSDGCYVQ 52  
RELYLGLRFD D+DS QSRVRNQGGLPG VHQNG CR T GEDSDGCYVQ  
Sbjct: 243 RELYLGLRFDSQSDS--QSRVRNQGGLPGA-----VHQNGRCRPETGAVGEDSDGCYVQ 302

Query: 53 LPRSRPALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
LPRSR + GPG G RP QAKLLAKKRVVR  
Sbjct: 303 LPRSRLEMMLTTPTTGPGPGRPNQAKLLAKKRVVR 339

[>] >gi|7106265|ref|NP\_031653.1| [■] cholecystokinin B receptor; CCK-B/gastrin receptor; CCK2/gastrin [Mus musculus]  
gi|3023828|sp|P56481|GASP\_MOUSE [■] Gastrin/cholecystokinin type B receptor (CCK-B)  
gi|2460177|gb|AAB71863.1| [■] CCK-B/gastrin receptor [Mus musculus]  
gi|9964011|gb|AAG09801.1| [■] cholecystokinin-B receptor [Mus musculus]  
gi|26390338|dbj|BAC25881.1| [■] unnamed protein product [Mus musculus]  
Length = 453

Score = 107 bits (267), Expect = 5e-23  
Identities = 66/97 (68%), Positives = 68/97 (70%), Gaps = 8/97 (8%)

Query: 1 RELYLGLRFDSQSDS--QSRVRNQGGLPGA-----VHQNGRCRPETGAVGEDSDGCYVQ 52  
RELYLGLRFD D+DS QSRVRNQGGLPG VHQNG CR T GEDSDGCYVQ  
Sbjct: 243 RELYLGLRFDSQSDS--QSRVRNQGGLPGA-----VHQNGRCRPETGAVGEDSDGCYVQ 302

Query: 53 LPRSRPALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
LPRSR + GPG G RP QAKLLAKKRVVR  
Sbjct: 303 LPRSRLEMMLTTPTTGPGPGRPNQAKLLAKKRVVR 339

[>] >gi|2654390|gb|AAB87706.1| gastrin/CCK-B receptor [Canis familiaris]  
Length = 454

Score = 104 bits (260), Expect = 3e-22  
Identities = 67/96 (69%), Positives = 70/96 (72%), Gaps = 7/96 (7%)

Query: 1 RELYLGLRFDSQSDS--QSRVRNQ-----GGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPR 55  
RELYLGLRFD DSDS+SRVR+Q G PG NG CRPE G GED DGCYVQLPR  
Sbjct: 245 RELYLGLRFDSQSDS--QSRVRNQ-----GGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPR 304

Query: 56 SRPALELTALTAPGPGSGSRPT--QAKLLAKKRVVR 89  
SR LEL+ALTAP PG G P QAKLLAKKRVVR  
Sbjct: 305 SRQTLELSALTAPTPGPGRPNQAKLLAKKRVVR 340

...>gi|232131|sp|P30552|GASR\_CANFA Gastrin/cholecystokinin type B receptor (CCK-B receptor)  
gi|423174|pir||S32817 gastrin receptor - dog  
gi|163957|gb|AAA30847.1| gastrin receptor  
Length = 453

Score = 104 bits (260), Expect = 3e-22  
Identities = 67/96 (69%), Positives = 70/96 (72%), Gaps = 7/96 (7%)

Query: 1 RELYLGLRFDSDSQSRVRNQ----GGLPGAVHQNGRCRPETGAVGEDSDGCVQLPR 55  
RELYLGLRF DSDS+SRVR+Q G PG NG CRPE G GED DGCVQLPR  
Sbjct: 244 RELYLGLRFDEDSDSESRVRSQGGLRGAGPGPAPPNGSCRPEGGLAGEDGDGCVQLPR 303

Query: 56 SRPALELTALTAPGPGSGSRPT--QAKLLAKKRVVR 89  
SR LEL+ALTAP PG G P QAKLLAKKRVVR  
Sbjct: 304 SRQTLELSALTAPTPGPGGGPRPYQAKLLAKKRVVR 339

...>gi|399533|sp|P30796|GASR\_PRANA Gastrin/cholecystokinin type B receptor (CCK-B receptor)  
gi|112583|pir||JQ1614 gastrin receptor - multimammate rat (Mastomys natalensis)  
gi|220647|gb|BAA02250.1| gastrin/cholecystokinin-B receptor [Mastomys natalensis]  
Length = 450

Score = 102 bits (253), Expect = 2e-21  
Identities = 65/96 (67%), Positives = 69/96 (71%), Gaps = 9/96 (9%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPGA----VHQNGRCRPETGAVGEDSDGCVQL 53  
RELYLGLRF D+DSD+QSRVRNQGGLPG VHQNG CR T A GED+DGCVQL  
Sbjct: 243 RELYLGLRFDGDNDSDTQSRVRNQGGLPGGTAPGPVHQNGGCRHVTVA-GEDNDGCVQL 301

Query: 54 PRSRPALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
PRSR + PPGP S QAKLLAKKRVVR  
Sbjct: 302 PRSRLEMTTLTTPTPGPGLAS-ANQAKLLAKKRVVR 336

...>gi|1813461|gb|AAE41677.1| gastrin/cholecystokinin-B receptor  
Length = 450

Score = 101 bits (251), Expect = 3e-21  
Identities = 65/96 (67%), Positives = 69/96 (71%), Gaps = 9/96 (9%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPGA----VHQNGRCRPETGAVGEDSDGCVQL 53  
RELYLGLRF D+DSD+QSRVRNQGGLPG VHQNG CR T A GED+DGCVQL  
Sbjct: 243 RELYLGLRFDGDNDSDTQSRVRNQGGLPGGTAPGPVHQNGGCRHVTVA-GEDNDGCVQL 301

Query: 54 PRSRPALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
PRSR + PPGP S QAKLLAKKRVVR  
Sbjct: 302 PRSRLEMTTLTTPTPGPGLAS-ANQAKLLAKKRVVR 336

...>gi|1813459|gb|AAB41676.1| gastrin/cholecystokinin receptor  
Length = 296

Score = 99.8 bits (247), Expect = 8e-21  
Identities = 65/96 (67%), Positives = 69/96 (71%), Gaps = 9/96 (9%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPGA----VHQNGRCRPETGAVGEDSDGCYVQL 53  
 RELYLGLRF D+DSD+QSRVRNQGGLPG VHQNG CR T A GED+DGCYVQL  
 Sbjct: 99 RELYLGLRFDGDNDSDTQSRVRNQGGLPGGTAPGPVHQNGGCRHVTVA-GEDNDGCYVQL 157

Query: 54 PRSRPALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
 PRSR + PPGP S QAKLLAKKRVVR  
 Sbjct: 158 PRSRLEMMLTTPTPGPGLAS-ANQAKLLAKKRVVR 192

[>gi|1813447|gb|AAB41829.1| gastrin/cholecystokinin receptor  
 Length = 316

Score = 97.8 bits (242), Expect = 3e-20  
 Identities = 64/96 (66%), Positives = 68/96 (70%), Gaps = 9/96 (9%)

Query: 1 RELYLGLRF--DSDSDSQSRVRNQGGLPGA----VHQNGRCRPETGAVGEDSDGCYVQL 53  
 RELYLGLRF D+DSD+QSRVRN GGLPG VHQNG CR T A GED+DGCYVQL  
 Sbjct: 111 RELYLGLRFDGDNDSDTQSRVRNQGGLPGGTAPGPVHQNGGCRHVTVA-GEDNDGCYVQL 169

Query: 54 PRSRPALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
 PRSR + PPGP S QAKLLAKKRVVR  
 Sbjct: 170 PRSRLEMMLTTPTPGPGLAS-ANQAKLLAKKRVVR 204

[>gi|6978617|ref|NP\_037297.1| cholecystokinin B receptor; CCK(B) receptor; CCK2  
 norvegicus]  
gi|232132|sp|P30553|GASR\_RAT Gastrin/cholecystokinin type B receptor (CCK-B recep  
gi|423801|pir|IA46195 cholecystokinin B receptor subtype - rat  
gi|203460|qb|AAA40925.1| cholecystokinin receptor  
 Length = 452

Score = 95.9 bits (237), Expect = 1e-19  
 Identities = 61/96 (63%), Positives = 65/96 (67%), Gaps = 7/96 (7%)

Query: 1 RELYLGLRF--SDSDSQSRVRNQ----GGLPGAVHQNGRCRPETGAVGEDSDGCYVQL 53  
 RELYLGL FD +DS++QSR RNQ G PG VHQNG CRP T GEDSDGC VQL  
 Sbjct: 243 RELYLGLHFGENSETQSRARNQGGLPGGAAPGPVHQNGGCRPVTSVAGEDSDGCCVQL 302

Query: 54 PRSRPALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
 PRSR + PGP G RP QAKLLAKKRVVR  
 Sbjct: 303 PRSRLEMMLTTPTPGPVPGPVQAKLLAKKRVVR 338

[>gi|1083622|pir|IS48049 cholecystokinin B receptor - rat (fragment)  
gi|558237|emb|CAA55798.1| cholecystokinin B receptor [Rattus norvegicus]  
 gi|31872397|qb|AAP59041.1| CCK2 receptor [Rattus norvegicus]  
 Length = 381

Score = 91.7 bits (226), Expect = 2e-18  
 Identities = 61/96 (63%), Positives = 65/96 (67%), Gaps = 7/96 (7%)

Query: 1 RELYLGLRF--SDSDSQSRVRNQ----GGLPGAVHQNGRCRPETGAVGEDSDGCYVQL 53  
 RELYLGL FD +DS++QSR RNQ G PG VHQNG CRP T GEDSDGC VQL  
 Sbjct: 172 RELYLGLHFGENSETQSRARNQGGLPGGAAPGPVHQNGGCRPVTSVAGEDSDGCCVQL 231

Query: 54 PRSRPALELTALTAPGPGSGSRPTQAKLLAKKRVVR 89  
PRSR + PGP G RP QAKLLAKKRVVR  
Sbjct: 232 PRSRLEMMLTTPTPGPVGPRPNQAKLLAKKRVVR 267

[>gi|2495001|sp|P70031|CCKR\_XENLA Cholecystokinin receptor (CCK-XLR)  
gi|1572485|gb|AAB09052.1| cholecystokinin receptor  
Length = 453

Score = 62.0 bits (149), Expect = 2e-09  
Identities = 32/93 (34%), Positives = 52/93 (55%), Gaps = 14/93 (15%)

Query: 1 RELYLGLRFDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCVQLPRSRPAL 60  
RELY G++F+ D + +++ H+NG P T G++ DGCV+Q+ + R +  
Sbjct: 261 RELYRGIQFEMDLNKEAK-----AHKNGVSTPTTIPSGDEGDGCVIQVTKRRNTM 310

Query: 61 ELTALTAPGPGSGSRP----TQAKLLAKKRVVR 89  
E++ LT R ++AKL+AKKRV+R  
Sbjct: 311 EMSTLTPSVCTKMDRARINNSEAKLMAKKRVIR 343

[>gi|26333421|dbj|BAC30428.1| unnamed protein product [Mus musculus]  
Length = 314

Score = 52.0 bits (123), Expect = 2e-06  
Identities = 28/39 (71%), Positives = 29/39 (74%), Gaps = 5/39 (12%)

Query: 1 RELYLGLRFDSQSRVRNQGGLPGAVHQ---NGR 34  
RELYLGLRF D+DS QSRVRNQGGLPG NGR  
Sbjct: 243 RELYLGRLFDGDNDSETQSRVRNQGGLPGGAAAPDFNGR 281

[>gi|2495000|sp|Q63931|CCKR\_CAVPO Cholecystokinin type A receptor (CCK-A receptor  
gi|2147182|pir|I151898 cholecystokinin A receptor - guinea pig  
gi|544724|gb|AAB29504.1| cholecystokinin A receptor; CCK-A receptor [Cavia]  
Length = 430

Score = 51.6 bits (122), Expect = 3e-06  
Identities = 34/96 (35%), Positives = 46/96 (47%), Gaps = 23/96 (23%)

Query: 2 ELYLGLRFDSQSRVRNQGGLPGAVHQNGRCRPETGAVG--EDSDGCVQLPRSRPA 59  
ELY G++FD+ ++ R + TG+ G EDSDGCV+Q R  
Sbjct: 235 ELYQGIKFDQKKSAKER-----KTSTGSSGPMEDSDGCVLQKSRHPRK 279

Query: 60 LEALTALTAPGPGSG-----SRPTQAKLLAKKRVVR 89  
LEL L+ GS S + A L+AKKRV+R  
Sbjct: 280 LE LRQLSPSSSGSNRINRIRSSSSTANLMAKKRVIR 315

[>gi|739858|prf|I2004206A cholecystokinin A receptor  
Length = 450

Score = 51.2 bits (121), Expect = 3e-06  
Identities = 34/96 (35%), Positives = 46/96 (47%), Gaps = 23/96 (23%)

Query: 2 ELYLGLRFDSDSQSRVRNQGGGLPGAVHQNGRCRPETGAVG--EDSDGCYVQLPRSRPA 59  
 ELY G++FD+ ++ R + TG+ G EDSDGCY+Q R  
 Sbjct: 255 ELYQGIKFDAIQKKSAKER-----KTSTGSSGPMEDSDGCYLQKSRHPRK 299

Query: 60 LELTALTAPPGPGSG-----SRPTQAKLLAKKRVVR 89  
 LEL L+ GS S + A L+AKKRV+R  
 Sbjct: 300 LELRQLSPSSSGSNRINRIRSSSSSTANLMAKKRVIR 335

[>gi|6978615|ref|NP\_036820.1| cholecystokinin A receptor [Rattus norvegicus]  
 gi|231713|sp|P30551|CCKR\_RAT Cholecystokinin type A receptor (CCK-A receptor) (CC  
 gi|285238|pir||A42685 cholecystokinin receptor type A - rat  
 gi|203384|gb|AAA40899.1| cholecystokinin receptor  
 gi|1100753|dbj|BAA09170.1| cholecystokinin type-A receptor [Rattus norvegicus]  
 Length = 444

Score = 50.8 bits (120), Expect = 4e-06  
 Identities = 33/95 (34%), Positives = 47/95 (49%), Gaps = 22/95 (23%)

Query: 2 ELYLGLRFDSDSQSRVRNQGGGLPGAVHQNGRCRPETGAVG--EDSDGCYVQLPRSRPA 59  
 ELY G++FD+ ++ + +P TG+ EDSDGCY+Q R  
 Sbjct: 250 ELYQGIKFASQKKSAKEK-----KPSTGSSTRYEDSDGCYLQKSRPPRK 294

Query: 60 LELTALTAPPGPGS-----GSRPTQAKLLAKKRVVR 89  
 LEL L+ GS S + A L+AKKRV+R  
 Sbjct: 295 LELQQLSSGSGGSRLNRIRSSSSAANLIAKKRVIR 329

[>gi|1582179|prf||2118221A cholecystokinin A receptor  
 Length = 428

Score = 49.7 bits (117), Expect = 1e-05  
 Identities = 34/97 (35%), Positives = 47/97 (48%), Gaps = 27/97 (27%)

Query: 2 ELYLGLRFDSDSQSRVRNQGGGLPGAVHQNGRCRPETGAVG--EDSDGCYVQLPRSRPA 59  
 ELY G++F++ ++ R +P T + G EDSDGCY+Q R  
 Sbjct: 235 ELYQGIKFASQKKSAKER-----KPSTTSSGKYEDSDGCYLQKTRPPRK 279

Query: 60 LELTALTAPPGPGSGSRPTQ-----AKLLAKKRVVR 89  
 LEL L+ GS SR + A L+AKKRV+R  
 Sbjct: 280 LELRQLST--GSSSRANRIRSNSSAANLMAKKRVIR 313

[>gi|4502607|ref|NP\_000721.1| cholecystokinin A receptor [Homo sapiens]  
 gi|416772|sp|P32238|CCKR\_HUMAN cholecystokinin type A receptor (CCK-A receptor)  
 gi|484443|pir||JN0692 cholecystokinin type A receptor - human  
 gi|306491|gb|AAA35659.1| cholecystokinin A receptor  
 gi|306596|gb|AAA02819.1| cholecystokinin A receptor  
 gi|1209500|gb|AAA91123.1| cholecystokinin type A receptor  
 gi|7008027|dbj|BAA90879.1| cholecystokinin type-A receptor [Homo sapiens]  
 gi|32482019|gb|AAP84362.1| cholecystokinin A receptor [Homo sapiens]  
 Length = 428

Score = 49.7 bits (117), Expect = 1e-05  
Identities = 34/97 (35%), Positives = 47/97 (48%), Gaps = 27/97 (27%)

Query: 2 ELYLGLRFDSQSRVRNQGGLPGAVHQNGRCRPETGAVG--EDSDGCYVQLPRSRPA 59  
ELY G++F++ ++ R +P T + G EDSDGCY+Q R  
Sbjct: 235 ELYQGIKFASQKKSAKER-----KPSTTSSGKYEDSDGCYLQKTRPPRK 279

Query: 60 LELTALTAPGPGSGSRPTQ-----AKLLAKKRVVR 89  
LEL L+ GS SR + A L+AKKRV+R  
Sbjct: 280 LELRQLST---GSSSRANRIRSNSSAANLMAKKRVIR 313

[>gi|2541920|dbj|BAA22847.1] cholecystokinin type-A receptor [Rattus norvegicus]  
Length = 307

Score = 49.3 bits (116), Expect = 1e-05.  
Identities = 33/95 (34%), Positives = 47/95 (49%), Gaps = 22/95 (23%)

Query: 2 ELYLGLRFDSQSRVRNQGGLPGAVHQNGRCRPETGAVG--EDSDGCYVQLPRSRPA 59  
ELY G++FD+ ++ + +P TG+ EDSDGCY+Q R  
Sbjct: 113 ELYQGIKFASQKKSAKEK-----KPSTGSSTRYEDSDGCYLQKSRPPRK 157

Query: 60 LELTALTAPGPGS----GSRPTQAKLLAKKRVVR 89  
LEL L++ GS S + A L+AKKRV+R  
Sbjct: 158 LELQQLSSSGSGSRLNIRSSSSAANLIAKKRVIR 192

[>gi|32400155|embj|CAD33800.1] cholecystokinin receptor [Gallus gallus]  
Length = 436

Score = 47.0 bits (110), Expect = 7e-05  
Identities = 34/93 (36%), Positives = 47/93 (50%), Gaps = 19/93 (20%)

Query: 1 RELYLGLRFDSQSRV-RNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPA 59  
RELY G+RF+ D ++ R+ LP ++ DGCY+QL R A  
Sbjct: 250 RELYRGIRFELDIKGEAAAQRSTEPLPTC-----DEGDGCYLQLSRPGGA 294

Query: 60 LELTALTAPGPGSGS--RPTQAKLLAKKRVVR 89  
LEL AL A G ++AKL+AK+RV+R  
Sbjct: 295 LELRALGAAGAQQERARINSEAKLVAKRRVIR 327

[>gi|12836122|dbj|BAB23512.1] unnamed protein product [Mus musculus]  
Length = 436

Score = 46.2 bits (108), Expect = 1e-04  
Identities = 31/93 (33%), Positives = 43/93 (46%), Gaps = 11/93 (11%)

Query: 2 ELYLGLRFDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPALE 61  
ELY G++FD+ ++ + G + R EDSDGCY+Q R LE  
Sbjct: 235 ELYQGIKFASQKKSAKEKRLSSGGGGGGSSSSRY-----EDSDGCYLQKSRPPRKLE 288

Query: 62 LTALTAPGPGS----GSRPTQAKLLAKKRVVR 89  
L L+ G S + A L+AKKRV+R  
Sbjct: 289 LQQLSTSSSGGRINRIRSSGSAANLIAKKRVIR 321

>gi|6753306|ref|NP\_033957.1| cholecystokinin A receptor [Mus musculus]  
 gi|6225102|sp|O08786|CCKR\_MOUSE Cholecystokinin type A receptor (CCK-A receptor  
 gi|7438588|pir||JC5599 cholecystokinin-A receptor - mouse  
 gi|2114152|dbj|BAA20068.1| cholecystokinin type-A receptor [Mus musculus]  
 gi|2984512|gb|AAC07949.1| cholecystokinin-A receptor [Mus musculus]  
 Length = 436

Score = 45.8 bits (107), Expect = 1e-04  
 Identities = 31/93 (33%), Positives = 43/93 (46%), Gaps = 11/93 (11%)

Query: 2 ELYLGLRFDSQSRVRNQGGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPALE 61  
 ELY G++FD+ ++ + G + R EDSDGCY+Q R LE  
 Sbjct: 235 ELYQGIKFASQKSAKEKRLSSGGGGGGSSSSRY-----EDSDGCYLQKSRPPRKLE 288

Query: 62 LTALTAPGPGS----GSRPTQAKLLAKKRVVR 89  
 L L+ G S + A L+AKKRV+R  
 Sbjct: 289 LQQLSTSSSGGRINRIRSSGSAANLIAKKRVIR 321

>gi|18088214|gb|AAH20534.1| cholecystokinin A receptor [Mus musculus]  
 Length = 436

Score = 45.8 bits (107), Expect = 1e-04  
 Identities = 31/93 (33%), Positives = 43/93 (46%), Gaps = 11/93 (11%)

Query: 2 ELYLGLRFDSQSRVRNQGGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPALE 61  
 ELY G++FD+ ++ + G + R EDSDGCY+Q R LE  
 Sbjct: 235 ELYQGIKFASQKSAKEKRLSSGGGGGGSSSSRY-----EDSDGCYLQKSRPPRKLE 288

Query: 62 LTALTAPGPGS----GSRPTQAKLLAKKRVVR 89  
 L L+ G S + A L+AKKRV+R  
 Sbjct: 289 LQQLSTSSSGGRINRIRSSGSAANLIAKKRVIR 321

>gi|1083155|pir||S50150 gastric CCK-A receptor - rabbit  
 gi|896235|gb|AAB32223.1| cholecystokinin receptor subtype A, CCK-A receptor=G pro  
 coupled receptor [rabbits, fundic epithelium, Peptide,  
 427 aa]  
 gi|1091571|prf||2021259A cholecystokinin A receptor  
 Length = 427

Score = 43.1 bits (100), Expect = 0.001  
 Identities = 36/94 (38%), Positives = 49/94 (52%), Gaps = 22/94 (23%)

Query: 2 ELYLGLRFDSQSRVRNQGGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPA-- 59  
 ELY G++FD+ ++ R A +GR ED+DGCY+Q RS+P  
 Sbjct: 235 ELYQGIKFASQKSAKERK-----ASTGSGRF-----EDNDGCYLQ--RSKPTRQ 278

Query: 60 LELTALTAPGPGSGSR----PTQAKLLAKKRVVR 89  
 LEL L+ G G SR + A L+AKKRV+R  
 Sbjct: 279 LELQQLSGGGGRVSRIHSSSSAAALMAKKRVIR 312

[ ] >gi|10719928|sp|O97772|CCKR\_RABIT Cholecystokinin type A receptor (CCK-A receptor  
gi|4205090|gb|AAD11547.1| gastric cholecystokinin A receptor [Oryctolagus cuniculus]  
Length = 427

Score = 41.6 bits (96), Expect = 0.003  
Identities = 33/94 (35%), Positives = 46/94 (48%), Gaps = 22/94 (23%)

Query: 2 ELYLGLRFDSQSRVRNQGGLPGAVHQNGRCRPETGAVGEDSDGCYVQLPRSRPA-- 59  
ELY G++FD+ ++ R A +GR ED+DGCY+Q RS+P  
Sbjct: 235 ELYQGIKFADASQKKSAKERK-----ASTGSGRF-----EDNDGCYLQ--RSKPTRQ 278

Query: 60 LELTALT----APGPGSGSRPTQAKLLAKKRVVR 89  
LEL L+ S + A L+AKKRV+R  
Sbjct: 279 LEQQQLSGGGGRVSRIRSSSSAATLMAKKRVIR 312

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Number of sequences in database: 1,538,680

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Gapped  
Lambda K H  
0.267 0.0410 0.140

Matrix: BLOSUM62  
Gap Penalties: Existence: 11, Extension: 1  
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Number of extensions: 1017597  
Number of successful extensions: 1602  
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Number of HSP's successfully gapped in prelim test: 3  
Number of HSP's that attempted gapping in prelim test: 1576  
Number of HSP's gapped (non-prelim): 15  
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effective length of database: 397,338,998  
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effective search space used: 9536135952  
T: 11  
A: 40  
X1: 16 ( 7.3 bits)  
X2: 38 (14.6 bits)  
X3: 64 (24.7 bits)  
S1: 42 (21.9 bits)

S2: 66 (30.0 bits)

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Title	Author	Journal	Year	Page
Palmitoylation of G protein-coupled receptor kinase, GRK6. Lipid modification diversity in the GRK family.	Stoffel, R. H., Randall, R. R., Premont, R. T., Lefkowitz, R. J., Inglese, J.	<i>J Biol Chem</i>	1994	269 (45):27791-4

**Entry Information**

Entry from: MEDLINE

**Entry Options**

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## Palmitoylation of G protein-coupled receptor kinase, GRK6. Lipid modification diversity in the GRK family.

Stoffel, R. H., Randall, R. R., Premont, R. T., Lefkowitz, R. J., Inglese, J.

Howard Hughes Medical Institute, Duke University Medical Center, Durham, North Carolina 27710.

GRK6, a 66-kDa serine/threonine protein kinase, is a recently identified member of the G protein-coupled receptor kinase (GRK) family. GRKs are involved in the phosphorylation of seven-transmembrane receptors, a process mediating desensitization of signal transduction. An important feature of these enzymes is their membrane-associated nature, which for some members is stimulus-dependent. The structural basis for this membrane association previously has been shown in different members of the GRK family to include isoprenylation, G protein beta gamma-binding domains, and basic regions to provide electrostatic interactions with phospholipids. We provide evidence that another mechanism includes fatty acid acylation. GRK6, but not other GRKs tested, incorporated tritium after incubation with [<sup>3</sup>H]palmitate in Sf9 and in COS-7 cells overexpressing the kinase. The incorporated radioactivity was released from the protein by neutral hydroxylamine, indicating the presence of a thioester bond, and was confirmed as palmitic acid by high performance liquid chromatography analysis. Site-directed mutagenesis defined the region of palmitate attachment as a cluster of 3 cysteines (Cys561, Cys562, and Cys565) in the carboxyl-terminal domain of the kinase, consistent with the location of the membrane targeting domains

of GRKs 1, 2, 3, and 5. Palmitoylation of GRK6 appears essential for membrane association, since palmitoylated kinase was found only in the membrane fraction. This lipid modification provides a structural basis for potential regulation of the subcellular distribution of GRK6 through acylation/deacylation cycles.

MedlineID: 95050538

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ISSN: 0021-9258

Publication Type:  
Journal Article

Substances:

Palmitic Acids

Plasmids

Potassium Channels

delayed rectifier potassium channel

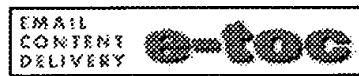
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G-protein-coupled receptor kinase 6

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# The metabotropic glutamate receptor mGluR4, but not mGluR1 alpha, is palmitoylated when expressed in BHK cells

**S Alaluf, ER Mulvihill and RA McIlhinney**

Medical Research Council Anatomical Neuropharmacology Unit, Oxford, England.

Several G protein-coupled receptors have been shown to be palmitoylated, and for some of these receptors the covalent attachment of palmitate has been implicated in the regulation of receptor-G protein coupling. The metabotropic glutamate receptor (mGluR) family forms a distinct group of G protein-coupled receptors, and the possibility that these may also be palmitoylated has been examined. Clonal baby hamster kidney (BHK) cells permanently transfected with the mGluR4 and mGluR1 alpha subtypes were labelled with [<sup>3</sup>H]palmitic acid. The cells were lysed, the receptors were immunoprecipitated with specific antipeptide antibodies, and the immunoprecipitates were analysed by sodium dodecyl sulphate-polyacrylamide gel electrophoresis and autoradiography. The palmitoylated, endogenously expressed G protein alpha-subunit alpha q could be immunoprecipitated from [<sup>3</sup>H]palmitate-labelled BHK cells expressing mGluR1 alpha using a specific antipeptide antibody, but in the same cell lysates no detectable [<sup>3</sup>H]palmitate-labelled mGluR1 alpha was found. This suggests that this mGluR subtype, associated with stimulation of phospholipase C, is not palmitoylated. In contrast, mGluR4, which is coupled to inhibition of adenylyl cyclase, was found to be labelled with [<sup>3</sup>H]palmitic acid, and the palmitate was quantitatively removed by treatment with 1 M hydroxylamine, suggesting attachment of the palmitate through a thioester bond. Stimulation with maximal doses of the neurotransmitter glutamate for 1, 5, or 10 min appeared to have no effect on the level of receptor palmitoylation.

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J. Neurochem., October 1, 2002; 83(1): 110 – 118.

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J. Biol. Chem., October 12, 2001; 276(41): 38139 – 38146.

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J. Biol. Chem., August 30, 1996; 271(35): 21490 – 21497.

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